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54 A method for filling and transport logistics

57 The invention concerns a method and device for filling and transport logistics in a storage facility for products that can be poured. In this regard, delivery data are supplied to a control unit (12). The control unit (12) uses the delivery data to generate control data for a filling unit (10). According to the delivery data, drums/cans (26, 28, 30) are kept ready in the appropriate sizes and are positioned on a transport unit (16) in the filling unit (10), on which they are transported along the filling stations (20) of the filling unit (10), in which case each filling station (20) is provided for the filling of a specific product.

The transport unit (16) is controlled on the basis of the delivery data in such a manner that the drums/cans (26, 28, 30) stop at the correct filling station (20), where they are filled with the desired product quantity according to the delivery data. The drums/cans (26, 28, 30) are closed and are moved to a delivery area together with other drums/cans (26, 28, 30) that form a part of the extent of delivery. Because of this invention, there is no need to maintain a material storage facility and the products can be prepared in an uncomplicated manner for an order.

The following data were taken from the documents supplied by the applicant.

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Description

This invention concerns a method and device for filling and transport logistics in a storage facility for products that can be poured.

Paints represent one product type that is stored in different qualities and colors.

These products are generally manufactured in large containers and are then poured into drums/cans of different sizes that are then stored. This creates a storage facility in which the drums/cans are stored in specific areas according to specific color qualities and tones and in different sizes. Upon receiving an order for different products in different drum/can sizes, it will be necessary to access these storage areas for just one order, in which case these areas may also be located far apart. Even if the access is achieved automatically, the loading of a pallet for an order would still require much effort. Furthermore, this method is associated with the problem of maintaining a storage facility that requires much space and exhibits the disadvantage that products with a specific shelf life must be either sold or disposed of after a certain period.

The target of the invention consists in the development of a method and a device that require no storage space and permit an uncomplicated product assembly for an order. This task is solved with a method in accordance with claim 1 and a device in accordance with claim 8. Advantageous further developments of the invention are the subject of the respective sub-claims.

According to the invention, the products are no longer poured into drums/cans and maintained in a storage facility, i.e., the manufactured product remains in a large container that may have been used for its manufacture. In accordance with the invention, the filling of the product in drums/cans occurs according to the order, i.e., the delivery data for an order are collected and these data are used to operate the filling unit in such a manner that the drums/cans requested in the order are assembled and these drums/cans are transported past the filling stations of the filling plant. Each filling station fills one product from one product container into a product container standing on a conveyor. As controlled by the delivery data, the empty drums/cans stop in front of the correct filling station and are filled there again according to the delivery data. On reaching the conveyor end, the drums/cans may be automatically or manually fitted with a cover and may be stacked on a delivery pallet. The advantage of this method and associated device consists in the fact that no storage facility is required for full drums/cans, since the drums/cans will be filled and stacked on a pallet shortly before or on the delivery date. Furthermore, this method permits coordination between the processing of individual delivery orders and a filling process that corresponds to the delivery schedule of the deliverer. Accordingly, the pallets could be loaded into the delivery vehicle one-after-another, thus permitting delivery and unloading according to the dates the orders were received.

Accordingly and on the basis of such a method and the related device, the previously required efforts regarding storage and transport logistics are unnecessary, the storage costs are reduced and, in most cases, there is no need to dispose of products that are too old and cannot be sold, since the individual drums/cans are filled only when these drums/cans can be sold immediately.

Furthermore, the method and related device in accordance with the invention require relatively few machines and devices. The system requires a control unit that takes care of all processes, i.e., collecting the delivery data, timely processing of delivery data from different orders and the operation of the filling unit. Such a control may be achieved with a microprocessor or a

personal computer. It is also possible to transfer different control tasks such as the collecting and timely processing of the delivery data and the operation of the filling unit to different control systems. Such a task-specific assignment of control hardware to different task areas corresponds to the average knowledge of an expert and is thus not explained further.

Of importance is the fact that a transport or conveyor unit that travels along many filling stations is provided, in which case each filling station is connected to a container for one product and this product is poured into the empty drum/can standing on the conveyor in front of the filling station. In that regard, the operation of the filling station is controlled by the delivery data for the delivery order.

This control effect can be realized in different ways. For reasons of clarity, only two alternatives will be described in more detail in the following.

In a first method or a first device, the empty drums/cans are loaded manually or automatically onto a conveyor. During this loading process or thereafter, the empty drums/cans are labelled with a designation that is at least machine-readable and is applied with a printer connected to the control system. The conveyor then transports the empty drums/cans along the filling stations. Each filling station is fitted with a read device for the designation and each filling station has a control unit that stops the conveyor when the data read on the drum/can indicate that the empty drum/can must be filled by the respective filling station. Since the delivery data include the delivery quantity, a pump or another product transport device of the filling station is operated such that the correct product quantity is poured into the empty drum/can. The control or adjustment and checking of the correct quantity can be achieved in a known manner, i.e., volumetricly or by mass.

It is particularly advantageous to arrange the empty drums/cans at a specific spacing on the conveyor, i.e., the spacing is equal to the distance between the filling stations located along the conveyor. In that manner, it is possible to fill several drums/cans simultaneously. Within this scope, the control system may even include a logic system that has stored the product sequence at the different filling stations and places the empty drums/cans in such a sequence on the conveyor that as many drums/cans as possible are always filled simultaneously. The whole filling process can thus be made as short as possible. In this case, the control unit must be equipped with a memory, in which the product sequence in the individual filling station at the conveyor is stored.

It is particularly advantageous to fit the drum/can not only with a machine-readable designation, but also with a written designation to permit immediate identification of the product.

The delivery dates must include at least the quantity and type of product to be delivered. They may also contain delivery date and delivery address. Furthermore, the designation may include batch number, order number and other product information.

Although the automatic labelling or designation of the empty drums/cans by the device in accordance with the invention is highly advantageous, it is basically also possible to manually place a self-adhesive label prior to or after the filling process.

A further development of the invention does not require a designation of the drums/cans. In this unit, all filling stations are directly connected to the control system for the filling unit.

The empty drums/cans are arranged manually or with an automatic stacking device in a predetermined sequence on the transport device such as a conveyor. When the empty drums/cans are placed manually on the transport device, a signalling device may be used to determine the empty drum/can that must be placed on the transport device. A storage facility for different empty drums/cans, i.e., empty drums/cans of different diameters and/or different heights, is generally maintained at the front of the transport device. When the empty drums/cans are placed manually on

the transport device, it is preferred to stop the transport device to place a new drum/can on it. In this scenario, the place is indicated accurately with a template, for example, thus permitting precise drum/can placement. At least one light barrier is arranged before the filling station and it is used to determine if an empty drum/can stands on the transport device. The light barrier may be used to check the position of the empty drums/cans on the transport device as calculated by the control unit. By arranging several light barriers correspondingly one-after-another and above each other, it will also be possible to determine diameter and height of the empty drum/can. It is thus possible to check not only the location, but also the size of the empty drums/cans standing on the transport device. Using the information obtained with the light barrier, the test logic system may then establish a corrective value for the position of the empty drum/can on the transport device and/or may give an error signal when the drum/can is of an incorrect size. Based on this signal, the error can then be corrected manually or automatically, e.g., by reversing the transport device and replacing the incorrect empty drum/can. Using the data obtained with the light barrier and/or based on the transport distance of the transport device, the control unit may precisely calculate the point at which the empty drum/can is located. The transport device moves each empty drum/can until it stands below the desired filling station. By way of a control signal from the control unit, the filling station is then instructed to fill a specific product quantity into the drum/can. This is generally achieved with a pump. The pump is generally connected to a volumetric measuring device or a weighing device is provided in the filling area of the filling station to check the quantity to be poured by way of the poured product mass. Both measures are sufficiently known in prior art. The pumps may be activated electrically or hydraulically. When the pumps are activated in a hydraulic manner, it is possible to use a hydraulic aggregate to operate the pumps of several filling stations

After the drum/can is filled with the appropriate quantity, the filling station transmits a signal to the control unit indicating the end of the filling process and enabling the control unit to further activate the transport device. At the end of the transport device, the full drums or cans are closed and stacked on a pallet with an automatic device or the full drums/cans are manually placed on a pallet. Although this second design example for the invention requires less hardware, since it does not require a reading device for each filling station to read the drum/can labelling, it nonetheless requires more control devices and wiring, since each filling station must be connected to a central control unit for the filling unit. The control units in the filling stations may be designed with a level of intelligence to the extent that the central control units provide them only with information about the start of the filling process and about the filling quantity. Conventional data lines may be used to connect the individual filling unit components. Particularly advantageous is the use of a serial data bus, in which all components work on the basis of a fixed protocol. Such a system is commercially available, very reliable and simplifies the replacement of individual components without affecting the overall operation.

When the labelling applied to an empty drum/can is used to control the filling process, it is preferred to arrange the drums/cans on the transport device in a defined position of rotation or a device for the placing of a designation is provided downstream of the device that transfers the empty drums/cans to the transport device. This also ensures a specific orientation of the designations. The area of the transport device is preferably secured against unauthorized access, thus preventing manipulation of the filling process. For that purpose, it is also possible to arrange light barriers laterally and parallel to the transport device to indicate when an object or person enters into the transport range or a drum/can has fallen out of the transport range. Together with an appropriate

number and arrangement of light barriers pointing perpendicular to the transport direction, it is possible to achieve a completely controlled and automatic filling of the drums/cans.

In each scenario, different drums/cans are filled in sequence with different products as specified in a delivery order, thus permitting sequential processing of delivery orders. With the help of an intelligent circuit provided in the central control system, the processing of the individual delivery orders is arranged such that the arrangement of the pallets holding the full drums/cans for the individual delivery orders corresponds to the schedule of the delivery route. This simplifies the product unloading for the driver as well as the customers.

The invention applies to all products that can be poured, such as liquids, suspensions, emulsions, fluids, and bulk material. The unit is preferably designed for the filling of drums/cans with a capacity of 100 ml to 50 liters according to the requirements. The devices may consist of all merchantable transport devices, such as conveyors, conveying rollers, suspended conveying or transport devices and individually activated transport platforms. In a preferred manner, the transport device is operated hydraulically or electrically, in which case the drive is controlled by the control unit in such a manner that the whole transport device or individual transport platforms are activated.

The invention will be described in the following with the help of the drawing. The following is shown:

Figure 1 shows a filling unit, in which the filling process is controlled by the labelling applied to a drum/can and

Figure 2 shows a filling unit, in which the control of the filling process is achieved with a central control unit.

Figure 1 shows filling unit **10**, whose nucleus consists of central control unit **12** that, through data line **14** is connected to a device to enter delivery data or to a unit that is used to process orders and that has the required input equipment to prepare delivery data sets. Through this data line **14**, central control unit **12** receives delivery data that may consist of delivery time, number of products and product quantity. When a delivery date is given, central control unit **12** initiates a filling cycle immediately prior to or on the delivery day, within which all products of the delivery order are filled sequentially and positioned on a pallet. For that purpose, central control unit **12** is connected with drum/can selection device **14**, transport device **16**, printer **18** and several filling stations **20** that themselves are connected to product container **22** and are fitted with their own reading device **24**.

The filling cycle proceeds as follows: The empty drums/cans required for the filling cycle are read by the central control unit on the basis of the delivery data. Drum/can selection device **14** stores different drums/cans **26, 28, 30** that differ with respect to diameter and/or height. Furthermore, drum/can selection device **14** is fitted with a rotating grab device **32** used to transfer a drum/can **26, 28, 30** from drum/can selection unit **14** to transport device **16**. In a preferred manner, grab device **32** places the drums/cans at a spacing "d" on the transport device, in which case "d" is equal to the fixed distance between filling stations **20**. In the transport direction of conveyor **16** and downstream, the drum/can selection unit has printer **18** that preferably consists of an ink jet printer. Empty drums/cans **26** through **30** are already fitted with blank labels, on which printer **18** prints the designation when the drums/cans pass by. For that purpose, and upstream of printer **18**, may be provided a rotation unit (not shown) to rotate the empty drum/can in front of the printing head of printer **18**, thus achieving perfect pressure on the drum/can cylinder. It is also possible for the empty drums/cans **26** through **30** to leave drum/can selection unit **14** without having a label applied and for the label for the drum/can to be printed by printer **18** in a generally known manner and is, with the help of an attachment device not shown here, affixed to the drum/can cylinder or to a drum/can cover resting beside the drum/can.

Accordingly, and in a preferred manner, the drum/can selection unit may position the drum/can covers as well as the empty drums/cans on the transport device.

In the transport direction and downstream of printer **18** is arranged light barrier **34** that is used to detect the position of a drum/can on the conveyor. This light barrier **34** is optional and serves to check the calculated locations of the empty drums/cans, i.e., it is not absolutely necessary. It is basically sufficient when grab device **32** of drum/can selection unit **14** positions a drum/can always precisely at a defined location on conveyor **16**.

After light barrier **34** are located five filling stations **20**, in which case each filling station **20** is used for one specific product. Filling stations **20** are connected to tanks for the respective product that are shown smaller and schematically. The containers may consist of those in which the product was manufactured. It is not absolutely necessary for tanks **22** to be in close vicinity to filling station **20**. They may also be connected to it through pipes. Filling station **20** generally consists of an electric or hydraulic pump, its own pump control system and a volume measurement unit or weighing unit to determine the poured quantity.

In printer **18**, each empty drum/can or its cover was fitted with a designation that on conveyor **16** faces reading devices **24** of filling stations **20**. As soon as reading device **24** recognizes that the product of the respective filling station must be poured into the drum/can, the respective filling station **20** sends a signal through data lines **26** to the control unit that arranges for conveyor **16** to stop. It is not absolutely necessary to run the signal by way of control unit **12**. It is also possible to connect each filling station **20** with transport device **16**. This makes sense particularly in the case each of the components, such as filling station, drum/can selection unit and transport device, has its own small control devices that are linked, for example, to a serial data bus.

By way of the designation on the drum/can, reading device **24** reads the filling quantity and the control device of filling station **20** arranges for the respective pump to begin the filling process. The filling process is stopped after the respective measuring unit has determined that the appropriate quantity was poured. Thereafter, a signal is given either indirectly through control unit **12** or directly through a signal to transport device **16** indicating that the filling process is completed and that the transport process may proceed.

Based on the fact that drums/cans **26** through **30** are positioned on conveyor **16** at the same spacing as filling stations **20** located at conveyor **16**, it is possible to simultaneously fill several drums/cans. In a control logarithm of control unit **12**, this fact can be used to arrange the placement of the empty drums/cans on the conveyor in such a manner that as many drums/cans as possible can be filled simultaneously during the filling process.

At the end of conveyor **16** may be located a generally known device (not shown here) to close the drums/cans. It may be controlled with a conventional light barrier control or also by way of central control unit **12**. Furthermore, it is possible to provide a device for transferring the full and closed drums/cans from conveyor **16** to a pallet. However, this work can also be performed by hand. The design form shown in **Figure 1** offers the advantage that the central control unit must guide only the operation of drum/can selection unit **14** and of printer **18**. Filling station **20** can be operated without using central control unit **12**, in which case this unit is relatively insensitive. However, each filling station **20** requires its own reading device **24** for the drum/can designation.

Figure 2 shows another design form of the invention, in which the operation of the filling station is also controlled by way of a central control unit. In this figure, parts of equal identity or function as shown in Figure 1 are designated with the same numbers. **Figure 2** shows filling unit **40** that is generally identical to filling unit **10** shown in **Figure 1**. In contrast to the filling unit shown in

Figure 1, filling stations **42** do not have their own reading device, but are connected directly through data lines **44** to control unit **12**.

In this filling unit, empty drums/cans **26** through **30** are positioned on the conveyor by grab device **32** of drum/can selection unit **14**, in which case the control unit memorizes the position of the respective drums/cans. Printer **18** provides the drums/cans with a designation that does not have to be machine-readable. Light barrier **34** can be provided to check the position of drums/cans **26** through **30** on transport device **16** as stored in control unit **12** and thus permit feedback to ensure that the stored positions are correct. Control unit **12** now moves the drums/cans to the precalculated points at each of which is located one filling station **42**. As soon as a drum/can has reached the desired point, control unit **12** stops conveyor **16** and activates the pump of filling station **42** to fill the drum/can with the desired quantity. After the end of the filling process that may be reported to control unit **12** with feedback from filling station **42**, control unit **12** initiates movement of the conveyor until all drums/cans located on conveyor **16** are full. As described earlier, the drums/cans can be closed and removed at the end of the conveyor.

This filling unit requires less hardware; however, all its functions are dependent on control unit **12**. To increase the safety of such a unit as well as of the unit shown in **Figure 1**, it makes sense to use two or three additional computers for control unit **12**, thus ensuring that the unit can continue its operation when one computer fails. Such redundant systems are known from prior art and these systems are thus not described in detail here.

Both of the above-described filling units exhibit the advantage that the filling process is based on orders received, i.e., only drums/cans that can be immediately transported thereafter are filled. Accordingly, there is no need to store full containers. Furthermore, there is also no need to dispose of products that are poured in containers and exhibit a short shelf life and thus become unusable after some time.

Patent claims

1. A method for the filling and transport logistics in a storage facility for products that can be poured, in which delivery data for a delivery order are supplied to a control unit (**12**), the control unit (**12**) uses the delivery data to generate control data for a filling unit (**10**), and drums/cans (**26, 28, 30**) are kept ready in the appropriate sizes according to the delivery data and are positioned on a transport unit (**16**) in the filling unit (**10**), on which they are transported past the filling stations (**20**) of the filler unit (**10**), in which case each filling station (**20**) is provided for the filling of a specific product; the conveyor (**16**) is controlled on the basis of the delivery data in such a manner that the drums/cans (**26, 28, 30**) stop at the correct filler station (**20**), where they are filled with the desired product quantity according to the delivery data; the drums/cans (**26, 28, 30**) are closed and are moved to a delivery area together with other drums/cans (**26, 28, 30**) that form a part of the extent of delivery.
2. A method in accordance with claim 1, characterized by the fact that the drums/cans (**26, 28, 30**) for a delivery order are together with drums/cans (**26, 28, 30**) for other delivery orders spatially arranged in a delivery area in such a manner that the spatial arrangement corresponds approximately to the delivery route of a deliverer.
3. A method in accordance with claim 1 or 2, characterized by the fact that the drums/cans (**26, 28, 30**) are fitted with a designation that contains information about delivery data.
4. A method in accordance with claim 3, characterized by the fact that the filling stations (**20**) are controlled by way of the designation.

5. A method in accordance with one of the previous claims, characterized by the fact that the filling stations (**20**) are operated through the control unit (**12**) of the filling unit (**10**)
6. A method in accordance with one of the previous claims, characterized by the fact that the drums/cans (**26, 28, 30**) are positioned at a defined spacing (d) on the transport unit (**16**), in which case said spacing (d) is equal to the distance between the filling stations (**20**) along the transport unit (**16**).
7. A method in accordance with claim 3, characterized by the fact that the drums/cans (**26, 28, 30**) are positioned in a defined position of rotation on the transport unit (**16**).
8. A device for the filling of several different products that can be poured, characterized by at least one control unit (**12**), at least one input station in connection with delivery data related to a delivery order, a container selection device (**14**) that either transfers the drums/cans (**26, 28, 30**) to the transport unit (**16**) according to the delivery data or indicates the drums/cans (**26, 28, 30**) that must be transferred to the transport unit (**16**), at least one unit to calculate (**12**) and /or recognize (**34**) drums/cans (**26, 28, 30**) on the transport unit (**16**) and at least one filling station (**20**) for each product arranged along the transport unit (**16**), in which case the filling station (**20**) is controlled by way of the delivery data and in which case the central control unit (**12**) or control units of the filling stations (**20**) and of the transport unit (**16**) control the interaction between the filling station (**20**) and the transport unit (**16**).
9. A device in accordance with claim 8, characterized by the fact that an identification device such as a printer (**18**) is provided upstream of the filling stations (**20**) and is used to designate the drums/cans (**26, 28, 30**) with the delivery data.
10. A device in accordance with claim 9, characterized by the fact that the filling stations (**20**) have a control unit that is fitted with a reading device to determine the control data for the filling stations (**20**) on the basis of the designation attached to the drums/cans (**26, 28, 30**).
11. A device in accordance with claim 8, characterized by the fact that each filling station (**42**) is connected with control unit (**12**) through a control and/or data line (**44**).
12. A device in accordance with one of claims 8 through 11, characterized by the fact that the drum/can selection unit (**14**) is formed by a stacking unit (**32**) that is controlled by the control unit (**12**) and transfers the drums/cans (**26, 28, 30**) from the drum/can storage area to the transport unit (**16**).
13. A device in accordance with one of claims 8 through 12, characterized by the fact that the filling stations (**20**) are spaced at an equal distance along the transport unit (**16**) and that the drum/can selection unit (**14**) is controlled such that the drums/cans (**26, 28, 30**) are positioned at the same spacing on the transport device (**16**).
14. A device in accordance with one of claims 8 through 13, characterized by the fact that at least one detection unit (**34**) for the drums/cans (**26, 28, 30**) is arranged in the area of transport unit (**16**).
15. A device in accordance with claim 14, characterized by the fact that the detection unit (**34**) has at least one light/laser barrier.
16. A device in accordance with claim 15, characterized by the fact that the detection unit has two light/laser barriers arranged at a given spacing and one after the other in the transport direction to determine the drum/can diameter.
17. A device in accordance with claim 15 or 16, characterized by the fact that the detection unit has at least two light / laser barriers arranged above each other to determine the drum/can height.
18. A device in accordance with one of claims 8 through 17, characterized by the fact that the drum/can selection unit (**14**) has an indicator or signal device arranged in the vicinity of the empty drum/can storage area.

19. A device in accordance with one of claims 8 through 18, characterized by the fact that the control unit (**12**) has a time control device that transmits the delivery data to a filling unit (**10**) in relation to a delivery date.

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2 pages with drawings form a part of this document

DRAWINGS PAGE 1

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Fig. 1

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Fig. 2